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—THE—

CANADIAN ARCHITECT AND BUILDER,

A Monthly Journal of Modern Constructive Methods,

(With a Weekly Intermediate Edition—The CANADIAN CONTRACT RECORD),

PUBLISHED ON THE THIRD SATURDAY IN EACH MONTH IN THE INTEREST OF

ARCHITECTS, CIVIL AND SANITARY ENGINEERS, PLUMBERS, DECORATORS, BUILDERS, CONTRACTORS, AND MANUFACTURERS OF AND DEALERS IN BUILDING MATERIALS AND APPLIANCES.

C. H. MORTIMER, Publisher,

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SUBSCRIPTIONS.

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EDITOR'S ANNOUNCEMENTS.

Contributions of technical value to the persons in whose interests this journal is published, are cordially invited. Subscribers are also requested to forward newspaper clippings or written items of interest from their respective localities.

The "Canadian Architect and Builder" is the official paper of the Architectural Associations of Ontario and Quebec.

The publisher desires to ensure the regular and prompt delivery of this Journal to every subscriber, and requests that any cause of complaint in this particular be reported at once to the office of publication. Subscribers who may change their address should also give prompt notice of same, and in doing so, should give both the old and new address.

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A FULL report of the proceedings of the second annual convention of the Ontario Association of Architects will be published in our next issue.

A GENTLEMAN from Toronto was a candidate at the recent examination for qualification as Associate of the Royal Institute of British Architects, and, we reget to observe, was not successful in passing.

A PUBLIC library to cost a million dollars or more is to be erected in Chicago. It is said to be the intention to ask for competitive designs, and to give $1,000 each to the authors of the five best designs. If these are the conditions, the inducements are too small to attract the efforts of men whose knowledge of the requirements of such a building could be relied upon.

THE fire losses in the United States during the year which has just closed, amounted to $125,000,000, being nearly 50 per cent. in excess of the previous year. This, despite the fact that there were no great conflagrations. The *Engineering News* points out that the expenditure of the money which thus goes up in smoke would go far towards rendering the buildings more nearly fire proof.

IT was the intention to publish in this paper drawings and specification in connection with the second of Mr. Hodson's series of articles on "How to Estimate." Some alterations in the drawings were thought necessary, however, in order that they might prove more instructive. This has made it necessary to defer their publication to the February issue. In this connection, if contractors see any way in which these articles might be made more serviceable, we shall be pleased if they will forward us their views on the subject. Any suggestion which may thus come to us will be carefully considered.

THE journeymen plasterers of Philadelphia refuse to work on the same building with graduates of the Plastering Department of the Master Builders' Trade School, of that city. The lads are desirous of completing their trade, and the master plasterers are anxious and willing to employ them. In pleasing contrast to the attitude thus assumed by the Philadelphia plasterers stands that of the Bricklayers' Union of Boston, which has arrived at the following understanding with the Master Builders' Association regarding trade schools: "Trade schools are to be established and opened evenings. Instruction therein is to be given all regularly indentured apprentices. None but regular apprentices shall be allowed to enter these schools. Instruction shall be given to pupils in the theory and science of the trade they propose to learn."

The Mansur-Tebbets warehouse in St Louis, constructed on the slow burning principle, was almost entirely destroyed by fire recently. The result is said to have been due to lack of promptness on the part of the fire department and scarcity of water, rather than to defective construction. Although the contents of the building were of a combustible nature, the fire burned for a considerable time on the two lower floors before extending to the upper stories. Mr. Edward Atkinson, the advocate of slow burning construction, referring to the destruction of this building, says: "I do not think that we shall reach the true fire-proof construction until we attain a method by which the building is constructed wholly of fire-clay, or brick and tile, without any wooden or iron members in the structure: similar to the method in which the new Boston Public Library

was constructed. I think that building comes nearer to being fire-proof than any building that I know; but such construction is, as yet, too expensive in this country to be applied to mills and commercial warehouses. It has, however, been adopted in Spain for textile manufactories, bleacheries and print works."

WHEN a metal beam or bar is subjected to a shock, there is a tendency to change the form or to bend the beam. When the load is removed or the shock is over, the beam will assume its original position unless the strain produced by the load or shock has been in excess of what is sometimes termed the elastic limit. It may be repeated an infinite number of times and yet there will be no evidence of any weakening of material; but if it be in excess of the elastic limit, it has only to be repeated a sufficient number of times to break the beam. However, there is another feature of the action of the metal which must not be overlooked. It is that the limit of elasticity is not constant throughout the succession of shocks required to break the beam. After the load has been several times applied and removed, it is found that a greater weight is required to produce the same amount of bending, that is, the limit of elasticity has been increased. It is, however, a question whether or not the safety of the beam has been increased.

A REVOLUTION is taking place in the methods of preparing stone for the various purposes which it is required to serve in building construction. In Chicago a great deal of the work formerly done by the skillful hands of the workman is now being accomplished in much less time and consequently at greatly reduced cost by improved machinery recently designed for the purpose. A gentleman who witnessed its operation states that the *modus operandi* is very similar to that to which lumber is subjected in passing through a planing mill—the material in its rough state entering at one end of the establishment and passing out at the other end in almost finished condition. Stone-cutters viewed the introduction of these machines with alarm, but the experience of the last two years is said to have shown that there is as great demand for skilled workmen as ever. The reduction in cost effected by the use of machinery has brought stone into use to a greater extent than before. There is likewise noticeable a tendency to indulge in more elaborate ornamentation. The employment of machinery would no doubt have lessened very materially the time and expense on the construction of the new Parliament, city and university buildings, Toronto.

THE difficulties incident to the erection of the Toronto Board of Trade's new building are not yet at an end. The limit set for the cost of the site and building was $350,000. The calculations regarding interest to be paid and probable revenue to be derived from tenants indicated that it would be possible to put aside annually the sum of $5,000 to establish a sinking fund for the redemption of the bonds on the building. There is little reason to doubt that had the construction of the building been entrusted to local architects, it would have cost little if anything more than the sum fixed as the limit. The secretary and Mr. H. W. Darling, a former president of the Board, were apparently very desirous that an American architect should be employed, and the upshot of the matter was that the work was given to Messrs. James & James, of New York. After a time rumors began to circulate that there were serious flaws in construction due to defects in the plans. The secretary of the Board positively denied that there was anything wrong, but eventually when this journal with the aid of sketches and figures taken from the work, printed the true facts of the case, it could no longer be concealed that blunders of a serious character had been made The architects were dismissed, and another American architect employed to complete the work, as it would never have done to have admitted that a mistake had been made in passing by competent local men. The mistake is none the less apparent in the fact, however, that the building required to a large extent to be reconstructed, and in consequence the limit of cost has been exceeded by $120,000. This extra cost has wiped out the possibility of devoting $5,000 a year to a sinking fund without increasing the fees of the members. As the only way out of the difficulty, it is now proposed to amend the by-laws to permit of doubling the amount of the annual membership fee. As a result of this proposal we have recently heard members asking one another what advantage was derived from their connection with the Board, and the answer was that the benefits to members other than those belonging to the grain section, are nil. Under these circumstances it is not surprising to hear members offering to sell out. "You will never be able to pay off the debt on that building in the world!" was the statement made by a member to one of the trustees of the Board the other day in the writer's hearing. "I know it," was the discouraging reply, and this was followed by the suggestion that it was useless to expect of economy as long as the Board had a secretary whose economic ideas were so ill-defined.

O. A. A. CONVENTION.

THE second annual convention of the Ontario Association of Architects will meet on Tuesday, the 2nd of February, at the School of Practical Science, Queen's Park, Toronto, at 2:30 o'clock, p.m. It is to be hoped that the proceedings will be of more interest than usual. We would strongly urge on every member of the Association to be present and take an active part in the proceedings.

Members who do not attend the annual meetings cannot justly make any complaint as to the manner in which the interests of the Association are conducted. If any member feels that some question which specially interests him should be considered, he should attend and bring the matter up, otherwise there may be no one present to bring it before the meeting.

This is a critical period in the existence of the Association, and it will require the assistance of every member to tide it over the next few years. If the members are loyal to the Association its success is assured. But if the members grow indifferent and careless, it will require all the energy and perseverence of its active workers to carry the Association until it has made for itself a solid foundation on the ability and loyalty of its younger members who will have come in by passing the examinations.

There are members who complain that the Association has not benefited them because they cannot obtain 5 per cent. commission, other members being prepared to work for less. The Association is unable to make rules or regulations which will bind the members except to a very limited extent, and certainly it is unable to force its members to charge any definite commission, even if such a course were advisable. When a man does not value his services at the regular rate of commission, but at a rate much lower, nothing can be done that will cause him to value his services at a higher rate. His services may not in reality be worth more than he is willing to receive, or he may be forced by circumstances to take what he can get.

It is a question if it would not be better for each man to settle for himself what his services are worth. A fixed rate of commission on all work of the same character to be paid alike to the competent or incompetent architect is unfair and unjust alike to the architect and the client. The client, if he knows what is best for him, will go to the most competent man that he can find, as he would not pay any more for his services than he would for those of an inferior man, except that a competent man will insist upon the work being thoroughly done, thus increasing the cost to the proprietor. This and similar questions could be brought up and discussed at the convention with benefit to all.

The testing machinery which has been recently erected in the School of Practical Science will be exhibited, and tests will be made of the building stones in use in the province of Ontario. Five well known members of the Association have consented to exhibit plans of houses and describe them, giving their reasons for arranging the plans as shown. These descriptions and the discussion which will follow will probably be of great interest.

There will be a number of valuable papers read, which, with the discussions upon them, should be of interest to every member. It is hoped that some members will come prepared to discuss the papers. Every member may not have the opportunity nor be able to take an active part in the work of the Association, but each member is able and should take sufficient interest in the progress of the Association to cause him to do all that may lie in his power, be it much or little, to assist and encourage those who are taking an active part. The member who does nothing to aid in the advancement of the Asssociation

but who is prepared to find fault and object to everything that is done, is not worthy of being called an architect.

The object of the Association is to advance the interests of architecture by educating its members to a knowledge of the work which as architects they are called upon to perform. By architects studying each other's work and exchanging ideas, the profession will attain to a higher standard of general proficiency which will raise its members from among the careless, ignorant, or for-gain-only architects of the present day.

The architect who follows his profession simply as a means of livelihood will see no benefit in any Association if it does not increase his income. Personal gain is his only object, and to obtain it he is prepared to erect any manner or description of building, from the most dangerous to life to the most inartistic conception that man can be guilty of designing.

The object of the Association is not to determine a tariff of fees and insist on its members maintaining them, but to work earnestly to raise the members to a higher standard of architectural knowledge, so that they may be enabled to demand and obtain just and reasonable remuneration through the fact that their services are absolutely necessary to the successful erection of every important building, if it is to serve the purpose for which it is being erected.

There are some who think that the architect who has a large practice is more interested in the success of the Association than the average member. This is far from true, for the man with a good practice is independent of any Association, and the more inferior in ability his opponents remain the better it is for him. It is the average man and the young architect who will benefit through the success of the Association and the general advancement of the profession.

Do not let any man think that he is unable to assist in the work of the convention. Every one can do something, and out of love to his profession let each member do all that lies in his power.

PRESBYTERIAN CHURCH COMPETITION.

WE write to draw the attention of our readers to this competition. The Presbyterian Church recognizes that the architecture of its churches is not creditable, and desires to bring about an improvement. The method decided upon is to issue a pamphlet with short essays upon architecture, to instruct the congregations as to what is good church architecture. To do this, thoroughly good designs are absolutely necessary for illustration, and such can only be obtained from architects.

The church can not afford to pay for designs for publication in the pamphlet in the usual way, so it was decided to ask the assistance of the architects. This assistance is now asked, and it is hoped a hearty response will be made by the architectural profession. The profession is interested in this movement, and should give it reasonable assistance and support.

There are many architects who are not any too busy at present, who should be able to send in good and suitable designs. Some may say that they will not do so because they will not receive any recompense. Well, such is a fact, but have they not in very many instances to the injury of the profession persisted in preparing designs and forcing them upon prospective clients when they were not asked to do so in the hope of being able to obtain a commission? Now in this instance, the preparing of a design may lead to a commission, possibly to many commissions, and there is nothing small nor lowering in the transaction, but the opposite, as the Presbyterian Church will be assisted in their effort to improve the church architecture of this country, and the competitor will have the pleasure of feeling that he did what he could.

There are many young men, and for that matter draughtsmen in offices, who could enter this competition with advantage to themselves and very probably with advantage to the object of the competition. Young men should seize this opportunity to find out just how they stand in comparison with their confrerés.

We strongly urge upon all architects and draughtsmen to render every assistance that may lie in their power to make this effort on the part of the Presbyterian Church a success.

A GOOD CEMENT.—For a glass-metal cement insoluble in carbon bi-sulphide, alcohol, water, etc., dissolve gelatine in water, add a small percentage of glycerine, and also a small quantity of potassic bichromate.

MONTREAL.

(Correspondence of the CANADIAN ARCHITECT AND BUILDER.)

THE hardware manufacturers and dealers of this city have started the circulation of a petition to the Government asking that a uniform appraisement of articles charged duty under the same clauses of the tariff at various ports of entry throughout the Dominion be arranged. The complaint is made that much inconsistency is shown by appraisers, and that in consequence of imperfect knowledge on the part of appraisers, imports at small ports enter at lower rates than in the cities.

PROVINCE OF QUEBEC ASSOCIATION OF ARCHITECTS.

The semi-annual examination for admission to study and for registration of the Province of Quebec Association of Architects, will be held at the Parliament Buildings, Quebec, on Monday, 25th January, at 10 a. m. Intending candidates are required to give one month's notice to the secretary, Mr. Chris. Clift, accompanied by the necessary fees: For admission to study, $10; for registration, $25.

A meeting of the Council of the Association was held on the 7th inst., the president, Mr. Berlinquet, presiding. It was decided to have a printed list of the names of all registered architects sent to members, that reasonable time should be allowed members to pay their fees, and should any fail to pay arrears within the specified time, their names will be struck from the roll.

In compliance with a request received from the Ontario Association of Architects, a Committee was appointed to arrange for the reading of a paper by a member of the Quebec Association at the approaching annual Convention of the Ontario Association.

It was agreed that all monies paid into the Association by students should be used directly for their benefit.

The Committee on tariff legislation reported that on account of the unsettled state of political affairs in the province at present, action by the Government had been delayed, but the indications are that if the tariff is not fixed too high, it will receive the sanction of the legislature.

Messrs. Dunlop and Maxwell have now a class of twenty-one students. It is the intention when the students are sufficiently advanced to take them out on sketching tours.

A paper was to have been read by Mr. Hayes, but the author found himself unable to prepare it before the next meeting.

BOARD OF TRADE BUILDING.

The sum of $200,000 has been subscribed towards the erection of the Board of Trade building. This is less than half the amount required, and judging by the difficulty experienced in obtaining it, considerable effort will be required to secure the balance. In a wealthy commercial centre like Montreal, money should be freely forthcoming for an enterprise of this kind. The methods of the Building Committee resembling so closely those of the Toronto Board of Trade, it may be that like results are expected to follow, which may possibly account in some measure for the tardiness with which the subscriptions have come in.

CANADIAN SOCIETY OF CIVIL ENGINEERS.

The annual meeting of the above society took place on the 13th and 14th inst. Time forbids more than a brief outline of the proceedings.

The question of co-operatining with American societies in entertaining members of foreign engineering societies at the World's Fair was not favorably regarded, but was left in the hands of the council.

Mr. D. H. Keely's paper on "Developments in Telegraphy" was awarded the Gzowski gold medal.

A committee was appointed to consider and report upon the standard system of testing, and also the tests upon Canadian and foreign cement, and report at the next annual meeting.

The election of officers resulted as follows:—President, John Kennedy, Montreal; Vice-Presidents, P. A. Peterson, Montreal; W. T. Jennings, Toronto; Thomas Munro, Coteau; Treasurer, Herbert Wallis, Montreal; Secretary, Clement H. McLeod, Montreal; Librarian, Wm. McNab, Montreal; members of the Council: H. T. Bovey, Montreal; J. Jobson, Hamilton; H. G. C. Ketchum, Fredericton, N. B.; H. N. Ruttan, Winnipeg; P. W. St. George, Montreal; C. E. W. Dodwell, Halifax, N.S.; H. J. Cambie, Vancouver, B.C.; K. W. Blackwell, Montreal; C. H. Keefer, Toronto; H. D. Lumsden, Toronto; F. W. Gisborne, Ottawa; A. McDougall, Toronto; J. D. Barnett, Stafford; F. C. Gamble, Victoria, B.C.; E. A. Hoare, Quebec.

SANITARY HOUSE DRAINS.

IN dealing with the question as to the proper size of drainage pipes for houses, Col. George E. Waring expresses a decided preference for soil pipes of small bore, his own dwelling being furnished wtth a soil iron pipe from above the roof to outside the building line, of three-inch diameter, this being connected with the street or main sewer by a three-inch earthen sewer from the building line; there is a fall of nearly half an inch to the foot, the distance outside from the house to the main sewer being 110 feet; on this three-inch line, with its two water closets, bath tub and kitchen sink, there have been during ten years' use not more than five or six obstructions, mainly due to the presence of the running trap on the main drain. In proving to his own satisfaction the inability of a three-inch soil pipe and house drain to carry off the sewage and waste matter of a private dwelling of average size, Colonel Waring does not recommend the use of three-inch pipe, but considers that a four-inch soil and drain pipe is sufficient for all dwelling houses, a four-inch being able to carry nearly 80 per cent. more than a three-inch pipe. In the same manner he declares in favor of a six-inch pipe for street sewers, though circumstances may exist where a larger pipe should be used.

BUILDING INSPECTION.

The following paper on "Building Inspection" was read last month by Mr. W. E. Doran, at a meeting of architects and students in the city of Montreal:

I will first treat of this question in its social aspect, as it is one, legislation upon which must necessarily be of a socialistic character; that is, it must be such as will control the actions of individuals in the interest of the public at large, and even in the interests of the individuals directly affected.

It is conceded that all matters affecting the safety and prolongation of life are proper subjects wherein the liberty of the individual is to be made subject to the interests of society. That man should live in healthy and safe habitations, and that the public buildings and places he frequents should be equally healthy and safe, is now an admitted axiom. In rural localities, self interest usually prompts the individuals building to in some measure attend to these points. The conditions of life, and the pure atmosphere in a great measure supply for any artificial precautions in regard to the former; and the simplicity of the construction to a certain extent ensures the latter.

It is then in cities, where the aggregation of large numbers of people, their overcrowding in particular localities and the consequent artificial modes of life therein adopted, render it incumbent that authority of some kind interfere as regards the habitations of men and their places of public resort. Thus building and sanitary precautions are to a large extent regulated by the state to civic control, and the power to legislate thereon delegated to municipal bodies. I may be considered as not keeping within the proper scope of my subject when I refer to sanitary matters; but having given the principles upon which cities affect to control building operations within their limits, I hold that a system of building inspection should be devised, which would be at once comprehensive of all the points upon which civic legislation is necessary, and which would secure as far as possible that such legislation be thoroughly enforced.

What is the first consideration in regard to a building? Site. Is it healthy? Is the soil capable of sustaining the structure to be placed upon it? If the answer to both these questions be "yes," then the work may proceed. If to both or either the answer be negative, then competent authority should say "The defects must be remedied or no building shall be erected." Here then I claim is the first matter which a building by-law should govern, and the first question for a competent building inspector to decide.

In connection with this I will add, even at the risk of digression, that no street should be built upon until the drainage therein is as perfect as engineering science can make it, and further, that at the time of constructing a public sewer, a connection should be made to each lot. Thus the soil would have some chance of being drained, rendering the site salubrious, and at the same time frequently converting bad into good building ground.

There is a good deal of attention paid now to the carrying off of sewage, to my mind mis-called "drainage"; whilst soil drainage is almost universally neglected, though from a sanitary point of view the latter is at least as necessary as the former. Provision should also be made for completely excluding ground air from dwellings, whenever it might in the slightest degree prove injurious; also an enactment requiring the introduction of damp-proof courses in all walls.

2nd. *Light and Air.*—The object for which the building is to be erected must determine the amount of free space which it should be imperative to adjoin it on the public street and on the property of the individual; all this should be provided for in a model by-law, and it should be the duty of the building inspector to see that its provisions were complied with before granting any permit to build.

3rd. *Materials and Modes of Construction.*—It is universally admitted that the fundamental parts of construction should be of fire-proof material, or at least of such materials as would tend to retard the progress of conflagration. In fact the first idea of civic building inspection was founded on the prevention of fire, but as the cities progressed in wealth and opulence on the one hand, and unfortunately in poverty and degradation on the other, it has become necessary to guard against such errors of construction in the more ambitious buildings as would render them insecure, not only as regards accidents by fire, but as regards cupidity of human nature from forcing the poor to herd in unwholesome, ill-built, and ill ventilated tenements, which might at any time become fire-traps or sources of pestilence.

How can a law be framed that will cover the various and multitudinous matters that must naturally have to be decided on by the building inspector? Let it be borne in mind that no matter how competent that officer may be, to a certain extent his usefulness is marred unless the law which he is called on to administer be clear, explicit, and clothes him with sufficient authority. It is evident that to meet the requirements of our modern cities, classification of buildings must be resorted to, and for different classes, certain matters of detail must be more carefully attended to than for others. For instance: For an ordinary self-contained dwelling or small tenement, it might be sufficient that after the matter of site, light and air had been satisfactorily attended to, that a general description of the building, with details of manner and materials of construction, drainage and plumber's fixtures should be deposited with the building inspector, and that the owner should be held to notify that officer at stated periods of the work, say at its commencement, when building should be ready for plastering, and again on completion, so that officer might see that everything was in compliance with the law. More important buildings should be graded according to their future uses, their altitude, and so forth, and for these the complete plans should be deposited in the building bureau, and any details as to calculations, etc., required by the inspector should be furnished. These should be verified and if satisfactory, a permit should be issued in which it should be mentioned the various stages at which the department would have to be notified, so that the work would be properly inspected. No deviation should be allowed from the plans without the sanction of the building bureau, and further, a very important point, no building should be used for any purpose which would require a higher classification than that for which it was built, but in justice to the designers and builders, and in deference to public safety, a building should not be overloaded after a few years by the erection of additional stories, or if designed for an ordinary store, or for light manufacturing purposes, should not be exposed to the danger of caving in, or of being converted into a warehouse of the first class, or collapsing from the vibrations of heavy machinery.

In no particular should building inspection be more stringent and severe than in the matter of alterations and additions to old buildings, and if the details of the buildings to be raised or altered do not exist, and unless it can be clearly shown that the possibility of such alterations and additions was provided for in the original construction; careful examination, and if necessary, tests, should be made before the proposed improvements should be sanctioned, and in no case should the factor of safety be diminished.

Special provision should also be made as to public buildings in case of fire, modes of egress, etc., etc. These in fact are pretty generally attended to, but there is one point that is generally neglected, viz., provision to enforce proper systems of ventilation, particularly in school buildings, where children are often found to breathe for hours a vitiated atmosphere. To this cause may be traced many diseases, the origin of which ofttimes puzzles physicians.

And the modern tall building, does it not call for some special attention? Is it to be allowed to tower above the reach of fire apparatus, unless constructed altogether and absolutely fireproof? Are elevators to be allowed to daily carry up and down precious loads of humanity without frequent inspection and tests? A prompt mode of dealing with existing structures which may become dangerous is also much needed, so that no one could defy the law, and one would not read as we often do after a disaster, "that the structure was condemned some years ago by the building inspector, but was nevertheless suffered to exist."

A building law should provide carefully for all these and many other details. Now how is such a law to be framed? Certainly not by a committee of aldermen with no technical knowledge, aided by an attorney of more or less legal ability, with a medical gentleman thrown in for the health points; after sitting down and making one or a half dozen conflicting by-laws on the subject, accepting such suggestions as they may think fit from their inspector. Can they hold that gentleman responsible for anything that may occur in any building, old or new, through the length and breadth of a great city, whether he had any notice of his attention being wanted in a particular locality or not, or the authority to interfere if he is aware that certain structures are dangerous? On the contrary, such a law would need long and careful study from competent men, and in its framing, our profession should certainly be consulted. I have purposely avoided anything savoring of local criticism, but I cannot resist the temptation of recording the fact that in one so-called by-law to regulate the construction of buildings in a certain city (you all know what city) no reference is made to the existence of an architect; it is altogether the owner and the builder whom the inspector is to deal with and ask for explanations. The authorities of the same city consulted the plumbers about a proposed sanitary by-law, but not the architects, who are supposed and expected to govern the former. I do not know if the same implied contempt for architects exists elsewhere, but I think I can safely assert that only with their assistance can a practical by-law be framed, which men of ability could accept, and which would be of service to those who wish to build honestly. It would also intimidate those willing to risk the lives of their fellow citizens for the sake of a slight saving of materials or labor, as it should be a penal offence to disregard in building anything which might be injurious to health or dangerous to life.

As to the officials of the building bureau, large cities should be districted, and an inspector appointed for each, who should be a thoroughly trained and experienced architect. All the accessories of building, both for sanitation and for safety, should, I claim, be under one bureau, and though the details of interior drainage might be left to special inspectors, still these should be subordinates of the building inspector, and under his control. The latter should be an official in the city engineer's department. All matters relating to building, such as the giving of lines, levels, permits, etc., should be attended to at the one office, so that information or plans once given by intending builders should serve for all these purposes.

I have said that building inspection as a general rule comes under civic control, but there is properly one exception. The state must necessarily exercise a supervision over factories, and in fact should over all public buildings where no local inspectors exist. However, in cities and towns possessing building inspectors, all general laws should be enforced by them, and the provincial or county inspectors should deal with the public only through them.

There is one point which I wish to emphasize, that is the public should not suppose that the building inspector is an architect employed by a paternal government, to take the place of the regular practitioner, and that he was obliged to give his services gratis to any one too mean to employ an architect. It should be clearly understood that the duty of a building inspector is to examine plans submitted to him, not to prepare, or give instructions for preparing them; that he has to approve or condemn, not to suggest or instruct. It is true when reviewing plans wherein some minor defects would be apparent, he might point these out, and suggest some

alterations, but this should be entirely at his own discretion. Again, it would be ridiculous to suppose that the examination of a building inspector at stated times of a structure, to see that vital points were attended to, could take the place of the regular and watchful supervision of the professional architect. I would not be in favor of seeking any legislation in order to compel people to employ architects whether they desire it or not, but I think with suitable and rigid inspection those building would perceive that it was to their own interest to have the services of a competent architect.

There is one more consideration which might possibly become a subject for legislation, but it is a very difficult matter to deal with. I refer to building regulations from an æsthetic point of view. Of course it would be impossible to establish a censorship over plans, and reject those which where considered ugly. Only autocratic power, joined to absolute good taste could do this. Still when a corporation at the public expense proceeds to beautify a city with parks and squares these improve the property in their immediate vicinity, and the public has a right to exact from the owners thus benefitted, that they shall not mar what has been done. If canons of good taste cannot be made law, at least it is possible to prevent mean buildings from being erected in such localities. It seems to me that the city should have power to regulate the minimum, or even in places where it would be desirable, the uniform height of buildings in parts specially favored, even if the favors consisted only of a better class of paving and sidewalks than were possessed by the city at large.

As to erections permitted in public property, such as our own Mount Royal Park, the plans should certainly be submitted to a competent commission to decide not only if they possessed merit of themselves, but also if they were in harmony with the scene, so that man might not mar the beauty which God created.

DESIGNS FOR WORLD'S FAIR MONUMENT.

QUEBEC, Jan. 5th, 1892.

Editor CANADIAN ARCHITECT AND BUILDER.

DEAR SIR,—Through being of French descent, I might be supposed to incline to the compliment of having the Effiel tower repeated at Chicago, and as having myself been one of the competing architects for the proposed London tower, I may be supposed to have somewhat maturely considered the subject. I fully agree with the editors of the *Scientific American*, and have no doubt the general consensus of opinion will bear them out in deploring the fact that any imitation of the Effiel tower is contemplated at the Columbian exhibition. The proposed structure, an engraving of which appears in their last issue, is, or will be looked upon, as they aptly foresee, as a servile and awkward imitation of its prototype, while without any of the elegance of the latter. It is, however, satisfactory to know, if they are certain they are rightly informed, that the structure is not to be fostered by the promoters of the exhibition, but to be merely a side show for penny purposes.

If the tower must be built, let us by all means have some alteration in its outline which will give it an air of originality, be it a cone or a pyramid, or the freestuns of an elongated cone, or better still, a series of superposed cylinders, decreasing in diameter, and thus leaving at each successive offset the breadth of a gallery with railing of sufficient height for security, and a floor at, say, every 100 feet, supposing this to be the height of section, with stairways and elevators around a central nucleus to reach the top—something, in a word, after the design submitted by me for the London tower. (See design No. 5 of the illustrated catalogue of the sixty eight competitive designs for the great tower for London, edited by F. C. Lynde, M. I. C. E., St. Stephens Chambers, Westminster, London, 1890). But best of all, why not carry out that grand, that novel, that almost sublime conception illustrated last year in the same journal, of a sphere surmounted by a fac-simile of the vessel in which Columbus sailed on his voyage of discovery. Then would the Columbian exhibition be truly unique and grandiose, and unlike anything the world has seen before. And with what simplicity of construction could not this be carried out, where all the parts can be made to one and the same model, if a perfect square, which it may be for simplicity and rapidity of construction, as the extra time and trouble of making the globe spheroidal, would hardly be warranted under the circumstances : the flattening at the poles being only one 300th ($3\frac{1}{4}$ ft. in 1,000), an inequality between the polar and equatorial diameters which no human eye, however well tutored, could detect. And this again a form, the construction of which is so facile where the Divine architect comes to our aid in the suggestion afforded by the component ungulæ or sections of an orange.

An erect globe, while not uncomplimentary to visitors from the southern hemisphere, the equator and the tropics, as less impartial to the ideas of middle-latitudinarians, would no doubt have some popular advantages, as, in such case, the polar axis pointing to the zenith, would allow of all visitors seeing their respective meridians and the hour circles in a plane vertical or perpendicular to the horizon, as when, from any point on the earth's surface, looking towards the poles of the heavens ; and this arrangement would, moreover, afford the opportunity of having the horizontal outer galleries to concord with the parallels of latitude, and, therefore, also with the arctic and ant-arctic circles, the equator, the tropics and the zones. These galleries could be easily reached from the interior by radiating footways from the aerial line, around the solid or well-like nucleus of which a double spiral stairway might extend from ground level to the top, the one ascending, the other downwards to avoid confusion, or by two or more hoists or elevators stopping on their way up and down at the several 10 degrees parallels of latitudes ($87\frac{1}{3}$ ft. apart as measured on a meridian), or both stairs and hoists might be used at pleasure. Nevertheless, the bulk of mankind being in the northern hemisphere, and all, or nearly all, in or near middle latitude or about half way between the equator and the pole, and as the erect globe would either place Columbus and his crew and craft, to crown the whole, in the Arctic Sea, if such there be, or lower and tilt his vessel to the latitude of the Atlantic, which would look awkward and unmonumental ; it may therefore on the whole be considered best, and so that Columbus may be the crowning figure at the summit, to tilt the axis of the tiny world to true parallelism with the axis of the earth, thus pointing to the opposite poles of the heavens. With this arrangement, the stairs and elevators having to be vertical, as in the former case, would come out at top under the hulk of the vessel, and the outer galleries, if any, would, as they must naturally be horizontal, cut the parallels of latitude and other circles at an angle or inclination to the horizon equal to the latitude or elevation of the pole. And should this scheme on the scale proposed—a globe of a diameter of 1,000 ft.,—be considered too gigantic, too costly in view of the advantages to be derived, let the diameter be reduced to 500 ft., and even at this figure would the proposed sphere have a cubical capacity of some 66 millions of feet, that is, greater by about 6,000,000 than that of the greatest of the far famed pyramids of Egypt. This decrease in the total height of the structure, from 1,235 to say 617 ft., would still leave it the greatest monument of the earth, bring its features of land and sea within easier distance of the eye and more at command of the search lights from the surrounding 250 ft. towers or observatories. The interior, I suppose, would be done in imitation of the starry firmament, with incandescent lights of varied candle power to give an idea of the varied brilliancy of the stars or planets.

Yours truly,

CHAS. BAILLAIRGE,
Architect and Engineer.

PUBLICATIONS.

The announcement that Mr. Howells will leave *Harper's Magazine*, to take editorial charge of the *Cosmopolitan*, on March 1st, calls attention to the process of building up the staff of a great magazine. Mr. Howells, who is recognized universally as the foremost American of letters, upon the expiration of his contract with Harper Brothers, on the first of March will take in hand the destinies of a magazine which promises to exercise a share of influence with the reading classes of the United States. His entire services will be given to the *Cosmopolitan*, and everything he writes will appear in that magazine during the continuance of his editorship.

Messrs. Merchant & Co., of Philadelphia, have published a book entitled "What Visitors will be shown at the World's Fair by Merchant & Co.'s Brownies." In a series of excrutiatingly funny engravings, representatives of every clime are portrayed as coming to the World's Fair, where they view with amazement and much delight. Merchants & Co.'s various exhibits, consisting of roofing plates, star ventilators, sheet copper, seamless tubing, electrical supplies, spiral rivetted pipe, solders and type metals, anti friction metals, etc. After observing their various useful applications, and witnessing the prize of merit being bestowed upon them, the visitors depart for home bearing with them as souvenirs samples of the materials mentioned, and also no doubt an appreciative opinion of the ability of a firm which succeeds in combining instruction enjoyment and business profit in so happy a manner.

The Barnum Wire & Iron Co., of Toronto Junction, have found it necessary to make an assignment for the benefit of their creditors. The liabilities are estimated at $50,000, and the assets at about half that amount. A difficulty with the town authorities concerning a bonus which was promised the company but which for some cause, was never paid to them, has had much to do with the present unfortunate result.

CANADIAN CITY ENGINEERS.

III.

MR. Henry Norlands Ruttan (member Institution of Civil Engineers, member Canadian Society Civil Engineers), City Engineer of Winnipeg, Man., commenced the study of engineering on the Grand Trunk Railway in 1867.

From 1869 to 1874 he was employed on the engineering staff of the Intercolonial railway—for the latter portion of that time, as engineer in charge of section 6 on the Baie Chaleur.

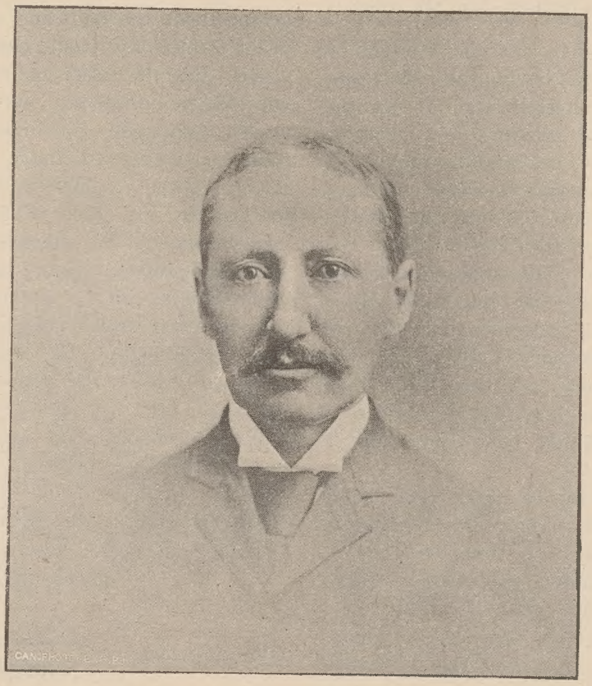
In the winter of 1873 he made an extensive survey of Shippigan Harbor in connection with the proposed short line across the Atlantic.

In 1874 he was employed on exploritory surveys on the north shore of Lake Superior, on the line now occupied by the Canadian Pacific Railway between the Pic and Nepigon rivers.

In 1875-6, as engineer in charge, he made the connecting surveys and location of the proposed line of the Canadian Pacific Railway between Edmonton and the Yellow Head Pass of the Rocky Mountains.

On the beginning of construction of the Canadian Pacific Railway between the Lake of the Woods and the Red river, Mr. Ruttan was engaged by the contractor of section 15, Mr. Jos. Whitehead, as contractor's engineer, where he remained until the work was practically completed and taken over by the Government in 1880, after which he took up his permanent residence in Winnipeg and practiced his profession as civil engineer and contractor.

The first bridge over the Red river in Canadian territory, at Emerson, was designed and built by him. The first 50 miles of the Manitoba South Western Railway was constructed for the Oregon Transcontinental Company by his firm. The first 45 miles of the Manitoba North-western Railway was constructed by him as engineer and contractor.



MR. H. N. RUTTAN, CITY ENGINEER, WINNIPEG.

In 1885 Mr. Ruttan was appointed City Engineer of Winnipeg. The duties of City Enginner in a new place like Winnipeg are not very well defined; they embrace all ordinary descriptions of engineering and architectural construction, as well as the care and maintenance of all streets and public buildings and other property of the city. The most important works are the sewers. The system now contains about 20 miles, and is being extended at the rate of about 3 to 5 miles per annum. The combined system is used. In the construction the most approved modern practice is followed. All sewer connections and plumbing are regulated by by-law and carefully inspected. Pending the adoption of more permanent pavements, cedar blocks are now used.

The city bridges, two iron and one combination, over the Red and Assiniboine rivers, the city buildings, city hall, fire halls, etc., are maintained by the City Engineer's department.

The importance of a good water system being fully realized by the city council, all matters in connection with the construction and operation of waterworks and their relation to the city have engaged the attention of the council, and exhaustive examinations and reports have been made on the subject. The council has also caused investigations to be made by the City Engineer into the merits of the several systems of electric traction for street railways, and are now endeavoring to have an extensive system established in the city.

Outside the ordinary duties of City Engineer, Mr. Ruttan has made reports and estimates of cost of the drainage and development of the lands surrounding the city; on the improvement of the navigation of the Red river between Lake Winnipeg and the city; and on the utilization of the water power of the Assiniboine river—three projects which, if carried out, will add materially to the wealth and population of the city.

PLAN DESIGNING.

THE best instruction in plan design is that of examining a number of designs for any kind of building, such as we meet with in a competition. By comparing the good and the inferior plans, we begin to discover what the strong points are in the good and the weak points in the mediocre plans. We shall find invariably that the poor plans are distinguished by looseness; that they are rambling and straggling; the corridors are long and crooked; the apartments thrown here and there without any connection. The salient mark of the good plan is invariably compactness and coherency. Again we look further. We find a method in the clever plan. If there are principal rooms or departments they have been consigned to positions having some distinct relation to the site; they are prominently located along some axis, or brought to play an important part in the general design. The inferior plan has no such method or principle apparent. Comparing again the plans, we find a waste of ground in the inferior set. Here there is a large space wasted in a corridor or area; but perhaps the entrance is cramped. If the site is irregular, it is ten chances to one the author has lost space along the curved or oblique boundary, that the blocks are made to follow the boundaries, and that the angles are not at right angles. The expert plannist has taken care to make his main frontages, if possible, square, so that the main walls should be parallel, and this he does because he knows the bad effect of crooked roofs and towers if their sides appear so on main facades.

Wasteful arrangements of corridors and offices are common, and so are areas for light. But the principle of economy is only learned after some experience, and depends mainly on the principle of compactness. Much space is lost in dealing with irregular boundaries. The novice is an adept at making crooked corners and leaving spaces. He generally places his blocks parallel to the oblique sides, and in thus disposing of them creates an irregular area in the centre, spoiling the interior of perhaps a hall or some apartment. The contrary process is the course resorted to by the skilful artist. The economical designer boldly makes his main blocks parallel to one principal street or boundary of the site, or assuming an axis, to which they are made parallel. The irregular corners left between the main building and the raking boundaries are thrown out on a rear or inferior side of the area, are filled up by subordinate offices, and are left simply as areas of triangular form for light and air.

Direct and easy access, well lighted corridors, suitable proportions of apartments, and that architectural finesse which distinguishes the masterly from the crude attempt, are other characteristic elements of a clever plan, to each of which we may refer; but these are details which follow from attention to the foregoing principles.—*Building News.*

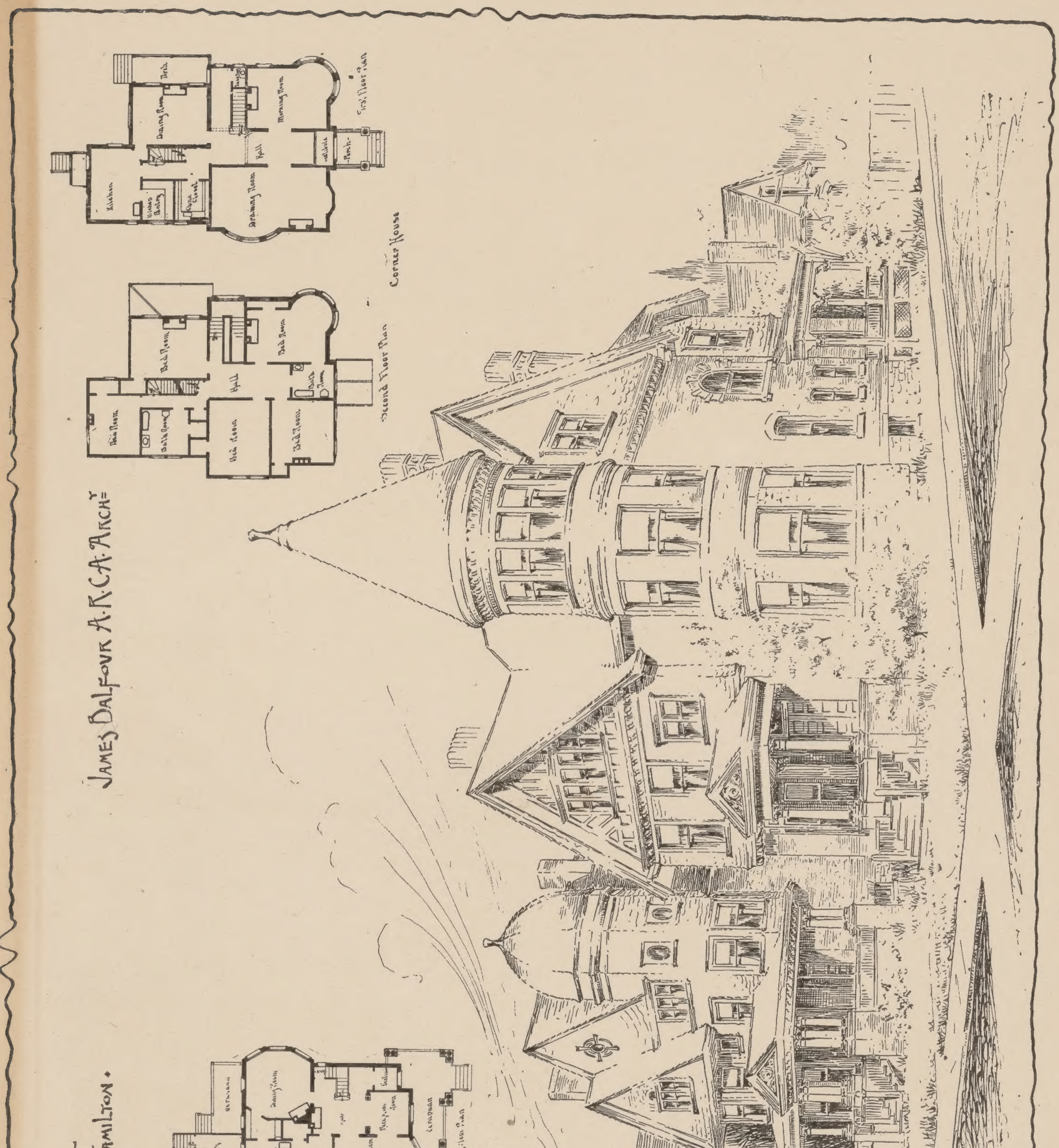
The stone for the new Toronto drill hall will come from the Deschambault quarries, near Portneuf, Quebec.

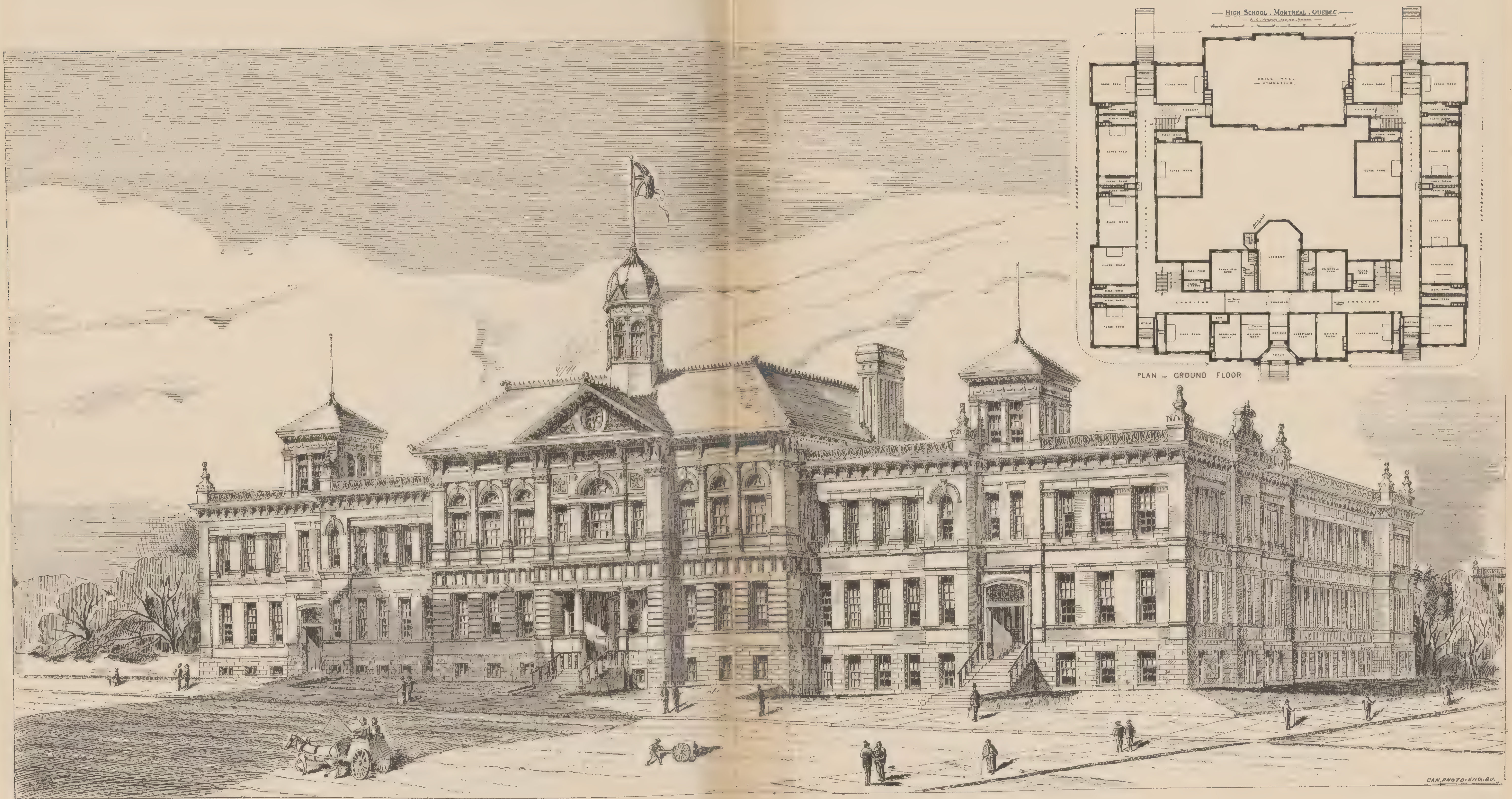
The Toronto Radiator Mfg. Co. have recently opened a branch warehouse at Victoria, B.C., in charge of Messrs. Muir & Boyd.

The Deseronto Company has been incorporated at Montreal with a capital stock of 50,000, to manufacture fire-proofing, fire brick, drain pipes, etc.

Joseph H. Farr and John M. Sparrow, of Toronto, have been granted a patent for a roofing composition consisting of petroleum tar mixed while hot with pine pitch, resin, or any other gummy substance, with or without slaked or powdered lime.

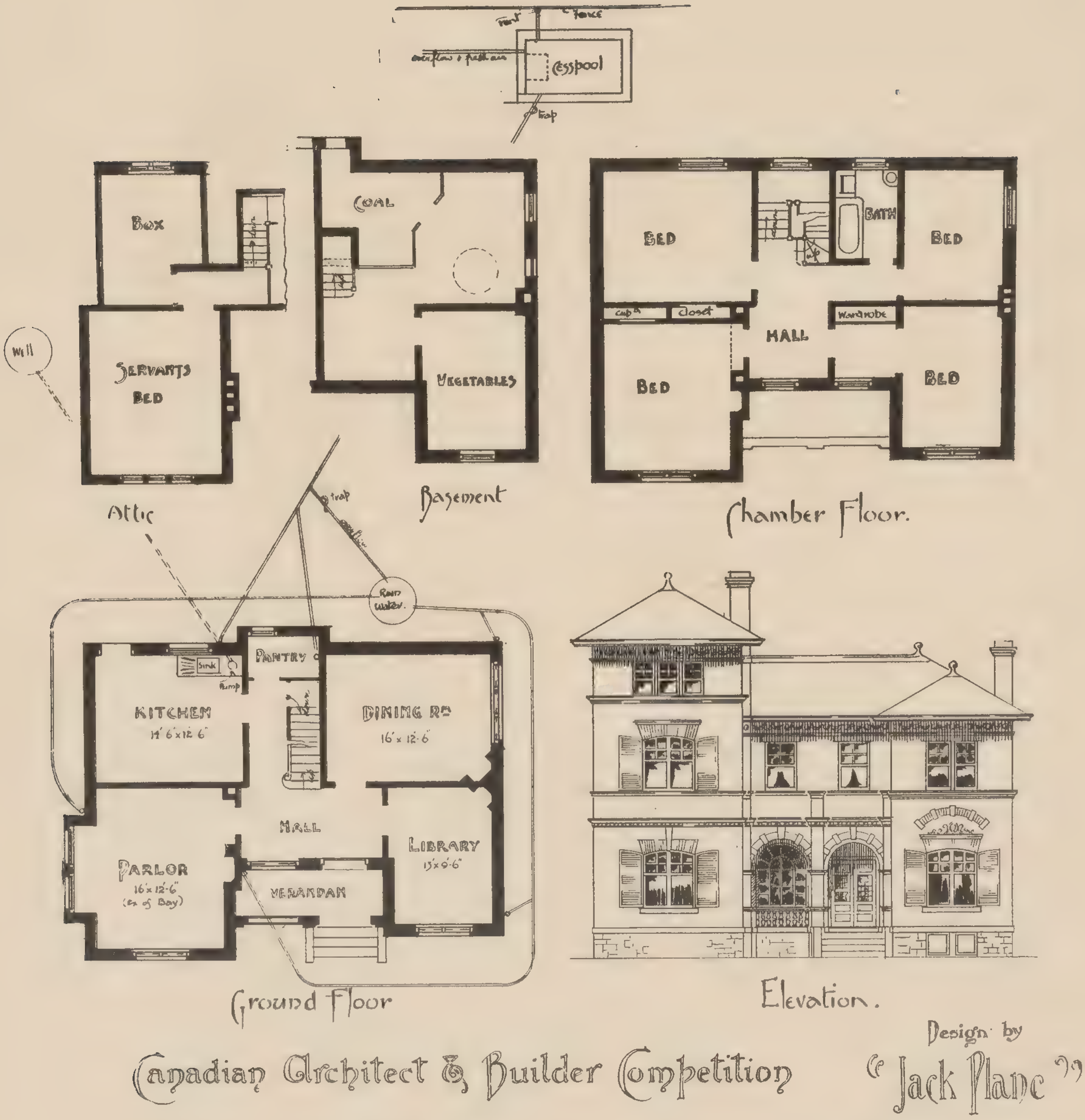
The National Brick Manufacturers' Association of the United States has appointed a committee of five to secure an international exhibition of clayworking machinery for the World's Fair. The committee have issued an address inviting the views of the trade.


Sketch of Two Residences –
Bay Street South – Hamilton.
for J. M. Lottridge Esq.
James Balfour A.R.C.A. Archt.
First Floor Plan
Second Floor Plan
Corner House
Second House
C. H. Acton Bond del.



NEW HIGH SCHOOL, MONTREAL, QUE.

ALEX. C. HUTCHISON, ARCHITECT, MONTREAL.



"C. A. & B." Competition for "A Suburban Cottage."

Design by "Jack Plane" (J. W. Siddall), Toronto, Awarded Third Position.

Residence of Capt. S. Crangle, Rosedale Road, Toronto.

Gordon & Helliwell, Architects, Toronto.

HYDRAULIC CEMENTS.

THE following instructive paper, by Mr. Edward F. Ball, was read before the members of the Toronto Architectural Sketch Club, at their meeting on the 4th inst :

MR. PRESIDENT AND GENTLEMEN,—It is a popular belief that the cements used by the ancient Romans in the construction of their roads, aqueducts and other public works was superior to any in use at the present time, and that the process of its manufacture is a lost art. It may seem somewhat startling, however, to state the fact that with all the advantages they have had in hardening slowly from two to three thousand years, probably none of them is equal in strength to good Portland cement mortar made of one part cement and two parts sand *one week old.* On the shores of the Bay of Naples cement is made and used at the present day in substantially the same manner as described 2000 years ago by the old architect Vitruvius.

In remote antiquity, before the Roman era, the builders of ancient cities all over the world depended for strength and durability upon the extreme accuracy with which they dressed the surfaces of the large stones which were to be placed in contact, and also upon the bronze dowels used in uniting them. With the Romans, beside accurate stone cutting, two kinds of mortar were used. In situations where it would not be exposed to the dissolving action of the water carefully prepared lime mortar was employed, while for quay walls, aqueducts, drains, cisterns, etc., hydraulic cement was used. As is well known, ordinary lime mortar will not set under water, but if lime be mixed with clay and burned at a high temperature, a substance is formed which sets and continues to harden indefinitely, even when immersed.

The purest limes, sometimes called rich or fat limes, when freshly burned combine readily with water, which process is termed slaking. In so doing they expand, evolve great heat, and fall to powder.

Impure limes, sometimes called poor limes, do not slake so readily.

Hydraulic limes, containing a considerable quantity of clay, scarcely slake at all, and possess the property of hardening under water.

Hydraulic cements do not slake at all, and will set and harden under water.

The particles of lime have greater adhesive than cohesive force, *i. e.,* they will adhere to other substances more strongly than to each other. In hardening, mortar made from lime alone changes volume, and for these two reasons, as well as for economy, sand is used in all mortar made from lime. Good hydraulic cement does not change its volume in setting or hardening, and its cohesive strength is greater than its adhesive, so that sand is used with cement simply for economy.

Cements are divided into two classes, Portland and Natural or Rosendale.

Portland cement was first invented or discovered in 1824 by Mr. Aspdin, of Leeds, England, while experimenting with some of the over-burned clinkers of artificial cement which was then being manufactured. After pulverizing and wetting up into cakes or blocks, it became very hard and in color resembled a limestone that was being quarried for building purposes on the Isle of Portland. In taking out a patent for the new product it was named "Portland." In certain localities natural deposits of rock are found, from which Portland cement may be manufactured, but fully nineteen-twentieths of the Portland used in the United States is artificial. It is made by thoroughly mixing together in suitable proportions clay and finely pulverized carbonate of lime (either chalk, marl, or compact limestone), burning the mixture in kilns at a high temperature, and then grinding the burnt product to fine powder between ordinary millstones. In England the ingredients of the cement are mixed together with a large quantity of water and afterwards dried, burned and ground. This is called the wet process. In Germany the ingredients are mixed dry. It is very important that the ingredients be correctly proportioned, finely ground and thoroughly mixed. No substance coarser than the one-thirtieth of an inch will make cement, and the finer the ingredients are ground the better. Thorough mixing is even more important than correct proportioning, as the temperature in the kiln is not allowed to rise high enough to liquify the mass, and in order that the chemical changes may take place, the particles of lime and clay must be in close contact with each other, otherwise uncombined or "free" lime or clay will be left. In the wet way of mixing, the chalk and clay being of different specific gravities, are liable to become deposited irregularly, even under the most careful supervision. In the dry method, when the water necessary to form the mass into bricks is added, the ingredients are liable to become separated unless the water is added carefully. The first chemical change which occurs in burning is the expulsion of chemically combined water and carbon dioxide; thus calcium carbonate $Ca\,CO_3$ is converted into lime $Ca\,O$. The silica $Si\,O_2$ which is present as silicate of alumina in the clay, is partly transferred to the lime, forming a double silicate of lime and alumina. A high temperature is necessary for the production of this double silicate, but at a lower temperature the alumina which was present in the clay as a base plays the part of an acid, and combining with the lime, forms a tri-calcium aluminate, $Ca_3\,Al_2\,O_6$, or as it may be written $Al_2\,O_3\,3Ca\,O$. If the temperature be too high, a lime glass is formed which has no hydraulic properties, and if the burning be continued at this temperature, a solid crystallization between the silicate and aluminates of lime is formed, which does not set.

SETTING OF CEMENT.

The setting of cement is a complex process, partly chemical, partly mechanical. The chemical reactions give use to substances which as soon as formed combine with water and constitute the true cementaceous material. The tri-calcium aluminate $Ca_3\,Al_2\,O_6$ is soluble in 3000 parts of water, and in the act of setting first dissolves and then begins to separate as a mass of felted needles, consisting of calcium aluminum hydrate, which extend in every direction and are directly the cause of the first setting of the cement. At the same time an action begins which requires a much longer time for its completion, and which probably consists in a combination of the first formed aluminium hydrate with the tri-calcium aluminate and the water forming a mineral of the probable composition $H_{10}\,Ca\,Al_2\,Si_4\,O_{17}$. This substance crystallizes out as it forms, and this continues to add to the solidity and tenacity of the cement for long periods subsequent to the first setting. Some experiments made by the writer seem to confirm the theory that aluminium plays an important part in the first setting of the cement, and also that this is dependent in a measure upon the solubility of some of the ingredients. The experiments are as follows: Aluminium, in the form of alum (either raw or burned) added to cement and moistened, causes the mass to rise greatly in temperature, showing that a chemical change is taking place, probably the formation of tri-calcium aluminate before referred to; a sample of Improved Union cement mixed neat with water, set in 20 minutes; a sample of the same cement with two per cent. of burnt alum added, set in 8 minutes; same with 4 per cent., set in 7 minutes; same with 6 per cent., set in 7 minutes. A solution of aluminium hydrate in caustic potash produced the same effects, but in a less marked degree. It is a well known fact among cement testers that in order to get the full strength of the cement it must be thoroughly mixed and kneaded or stirred after the water has been added. This seems to indicate the presence of a soluble constituent which it is necessary to diffuse throughout the mass in order to obtain the maximum strength. If dry cement be forced into moulds under a pressure of say 70 lbs. per sq. inch, and then allowed to absorb water, a very dense, hard briquette will be formed, but it will be very weak in strength, and also very uncertain. If sufficient water be added to dry cement to properly moisten it, and if the mass be stirred just sufficiently to ensure thorough and complete moistening, and the briquette put into the moulds in the usual way, it will not be so dense or compact as if made in the way described, but will be much stronger. If, instead of slightly stirring the moistened cement, it be thoroughly turned and kneaded as long as possible before setting begins, the best and strongest briquette may be made. All this, in the opinion of the writer, points to the existence of a soluble constituent as before remarked.

IMPURITIES.

If by reason of imperfect proportioning, grinding or mixing, any portion of the lime fails to combine chemically with the silica or alumina of the clay, this is known as "free lime," and when the cement is fresh, is in the form of CaO. Upon exposure to the air it absorbs moisture and becomes slaked, thus: $CaO+H_2O=Ca(OH)_2$. Upon still further exposure it slowly absorbs carbon dioxide, and returns to its original composition before being burnt, viz., carbonate of lime: $Ca(OH)_2+C\,O_2=Ca\,C_3\,O+H_2\,O$. When present in the unslaked form, $(Ca\,O)$, free lime is one of the most dangerous impurities in cement, as upon the addition of water it slakes and expands, thereby disturbing the setting of the cement. This slaking is not rapid like that of rich or fat limes, and often its effects are not apparent for the first day. It frequently happens that samples of cement will stand a good tensile strain at the end of 24 hours, while at the end of seven days the strength will hardly be greater than the 24 hours test—sometimes even below it. This generally indicates free lime, and in such a case the sample should be exposed to the air for a week and a second test made. If this test comes up to the standard, the trouble is due to the presence of free lime, and the cement may be accepted provided the other tests are satisfactory, on condition that it be spread out and exposed to the air for a week or more before use. If the lime have sufficient activity, thin cakes of the cement immersed in water for a week will become cracked, but if the lime is not present in sufficient quantity or has not the necessary activity, no cracks may appear. In order to render this test more effective, the cakes or pats may be exposed as soon as they are hard to a high temperature saturated with moisture for about three hours, and then boiled for twenty-four hours. Two per cent. should be the limit of this impurity, especially if the cement be for use under water; for use in air the presence of free lime is not so injurious, provided, of course, that it is slaked. Free lime retards the setting of cement and impairs its hydraulicity. When present in considerable quantity the cement will disintegrate on immersion, unless first allowed to become quite hard in air. In determining the amount of free lime in cement by chemical analysis, it is customary to find the amount of $C\,O_2$ on the supposition that the free lime is all in the form of carbonate, and then calculate the amount of $Ca\,O-1$ per cent. of $C\,O_2$, indicating 1.3 per cent. of $Ca\,O$. This, however, is a very unreliable method, as the lime must first be hydrated and then carbonated. This requires a long time if exposure to the air is relied upon to effect the change, as is usually the case. Hydrogen Sulphide, H_2S, is often evolved with the carbon dioxide, and this also affects the accuracy of the test.

Magnesia (in the free state) is another dangerous impurity. It may not prevent the cement from setting and becoming apparently as hard as though it were absent. For a long time it may remain inert, and perhaps for months there may be no apparent change. The magnesia, however, has an affinity for water; every two pounds of magnesia in becoming hydrated, takes up and solidifies one pound or 27.7 cubic inches of water, and in bulk every ton of magnesia would have to find room for about 16 cubic feet of water. In finding room for this water the mortar becomes disintegrated. The action continues whether in air or in water, and is especially disastrous in concrete work. Instances are recorded where concrete works have failed although built in the usual manner with cement that had stood the ordinary mechanical tests. The concrete set as hard as usual, but after a time expansion set in. In one case, a vertical wall about 35 feet high was lifted about 2½ inches, in another, a mass of concrete 16 feet thick was lifted from ½ to 1¼ inches. In both cases a white substance of the consistency of cream was seen in the concrete. On being analyzed, this substance was found to contain 80 per cent. of magnesian hydrate, consisting of about ⅔ magnesian oxide and ⅓ water. The writer made some experiments with five per cent. by weight of calcined magnesia added to Improved Union cement. The magnesia was found to render the paste very plastic and easily worked. It retarded the setting from twenty minutes to two hours, and greatly decreased the strength of the cement, as follows:

Neat cement, 1 day old, tens. strength -	= 45	lbs. per square inch.
" " 1 week old, " " -	= 74	" "
Cement with 5% mag., 1 day old, tens. strength,	= 1	" "
" " " 1 week old, "	= 19	" "
" " " 2 " "	= 36	" "

At the end of one week the pats were very soft; the outside was light-grey and the interior the usual color. Good Portland cement should in no case contain more than one per cent. of magnesia.

By the rules of the "Ecole Nationale" of Paris, if the amount of sulphuric acid exceeds 1½ per cent., the cement is rejected on the chemical analysis alone.

When Portland cement is properly burned, it forms a very hard clinker, which is expensive to grind to the fineness now demanded by engineers, as the machinery requires constant repair. To render the grinding easier, iron slag meal is sometimes added to the cement clinker. This slag cement may be recognized by its lighter specific gravity (2.60) and by its color, which is a mauve tint in powder, while the inside of the water pat when broken is deep indigo. Its presence when mixed with Portland may be detected as follows: To a gill of water, add about 80 drops of sulphuric acid. Into this drop 25 grains of the cement and stir rapidly with a glass rod, and while still stirring, pour in drop by drop, a solution of Condy's fluid (64 grains of permanganate of potash to one pint of water) until the red color remains permanent. Genuine Portland will require only 10 to 15 drops of the permanganate solution, whilst an adulterated cement will take considerably more—30 to 60—and a cement made from slag over 200 drops. The principle of this test is as follows: Solid permanganate of potash is at once decomposed by the addition of strong acids, but in water solution this decomposition does not at once take place except by contact with oxidizable substances. This action is apparent by the change of color, the deep purple being rendered colorless. All Portland cements contain a small quantity of iron; thus with unadulterated cements a certain amount of the permanganate will be bleached, but cements containing iron in undue proportions will bleach a much greater quantity of the solution. A simple test for the same purpose is as follows: Place upon a clean silver coin a thin layer of cement, and drop on it a small quantity of dilute sulphuric acid (one acid to seven water) and afterwards rinse with water. If the cement be genuine Portland, the treatment will only slightly affect the color of the silver, but if slag be present in any notable proportion, a dark brown stain will be produced. Slag cement has been for some time manufactured in Germany, and works

have also been established for its production in England. Being a mechanical mixture of iron slag with slaked lime, it is very different in its constitution from Portland cement, which is a true chemical combination. It is stated by its inventors to be fully equal in quality to Portland cement; this, however, is not admitted by the highest authorities. Cement adulterated with slag and slag cement will be found finer ground and quicker setting than Portland, and it will attain its maximum strength in a shorter time than the best Portland, but retrogression then takes place which is most treacherous in its nature. The failure of the concrete construction of the Aberdeen harbor works is now attributed to the use of cement which was not true Portland, although at first it was considered that the action of the sea water was the cause, but examinations of similar constructions built with good Portland cement many years previously proved, that when the proper material is employed and due care exercised in construction, permanency is assured.

Salt is often added to the water used in mixing mortar in cold weather, to prevent the mortar from freezing before it has set. Authorities differ regarding the effect of salt. The most reliable information is probably contained in the report of the tests made at Governor's Island, New York harbor, by Mr. John Gartland for Col. D. C. Houston, U. S. engineer, and also of tests at the Cairo bridge. In the first mentioned tests, sea water was used, and was found to increase the strength of the cement from 1 to 80 per cent., except in the case of Hoffman Rosendale two months old. At three and six months, this same cement gave higher tests with sea water. About 330 briquettes from 8 brands of cement were tested, so the results seem entirely reliable. In the tests at the Cairo bridge the mortars were mixed in the proportion of 1 volume of cement to 2 volumes of sand. The tests were made in the manner recommended by the American Society of Civil Engineers. Each result is the mean obtained from 10 briquettes at the age of six months. The general opinion of engineers that sea water decreases the strength of cement is probably based on Gillmore's experiments, which were not nearly so comprehensive as the above.

TABLE SHOWING RESULTS OF TESTS WITH SALT AND FRESH WATER, MADE BY MR. JOHN GARTLAND, GOVERNOR' ISLAND, NEW YORK HARBOR.

BRAND.	1 DAY Fresh	1 DAY Salt	1 WEEK Fresh	1 WEEK Salt	1 MONTH Fresh	1 MONTH Salt	2 MONTHS Fresh	2 MONTHS Salt	3 MONTHS Fresh	3 MONTHS Salt	6 MONTHS Fresh	6 MONTHS Salt
Rosendale, old	56	81	106	163	218	286	—	—	—	—	—	—
" , Hoffman	—	—	—	—	—	—	295	278	264	318	292	372
Lawrence Cem. Co.	—	—	151	191	—	—	—	—	—	—	—	—
Rosendale, "Improved"	—	—	142	216	—	—	—	—	—	—	—	—
Catasauqua (Am.)	292	351	—	—	—	665	692	721	769	871	776	855
Newark Co.	—	—	—	—	—	—	220	291	279	331	222	399
Alsen's Portland	345	348	518	612	556	620	665	752	684	770	772	797
Hercules Portland	—	—	527	584	—	—	—	—	—	—	—	—

TABLES SHOWING THE RESULT OF TESTS MADE AT THE CAIRO BRIDGE:

BRAND OF CEMENT	FINENESS % passing No. 50 sieve	FINENESS % passing No. 100 sieve	TENSILE STRENGTH, LBS. PER SQUARE INCH 0% salt	2% salt	4% salt	8% salt	12% salt
Portland, Alsen's, Louisville	99.2	87.0	201	213	223	215	245
Falls City Mills.	92.4	83.5	176	179	172	146	156

Sugar added to mortar has the same effect in preventing freezing that salt has. It also combines chemically with the lime, forming a sucrate of lime, which is a detriment to cement mortar, but increases the strength of lime mortar, especially in the heart of thick walls, where lime would not harden under ordinary conditions. An excess of clay in cement is said by some to make the mortar more easily affected by frost. Over clayed cements, if underburned, set quickly and give a high test, but they are liable to injury during calcination by changes of temperature, while cement containing a slight excess of lime is not easily injured thereby.

REQUISITES FOR GOOD PORTLAND.

Good Portland should be burned at a high temperature, which is indicated by high specific gravity (95 lbs. per cubic foot) and slowness in setting (2 hours or longer). The color indicates but little, since it is chiefly due to the oxides of iron and manganese. Gray or greenish gray is considered best; bluish gray indicates a probable excess of lime; brown, an excess of clay. A mauve tint indicates adulteration with iron slag, and an undue proportion of underburned material is generally indicated by a yellowish shade, with a marked difference between the color of the hard burned unground particles retained by a fine sieve and the finer cement which passes through the sieve. The fineness should be such, that 90 per cent. by weight will pass through a sieve of 2,500 meshes per square inch made of No. 40 wire (Stubb's wire gauge). Made into cakes or pats about $2\frac{1}{2}$ inches square and $\frac{3}{8}$ inch thick and immersed in water immediately after setting, it should show no cracks at the end of a week. The tensile strength of Portland cement should be about as follows, a very high strength within four weeks generally indicating an unsound cement:

COMPOSITION NEAT OR SAND	TENSILE STRENGTH LBS. PER SQ. INCH. 24 hours.	1 week	1 month	1 year.
Neat cement..............	100 to 140	250 to 550	350 to 700	450 to 800
3 parts sand to 1 part cement	———	80 to 125	100 to 200	200 to 350

It should not contain impurities in excess of the following quantities: Magnesia, 1 per cent.; free lime, 2 per cent.; sulphuric acid, $1\frac{1}{2}$ per cent.; ferric oxide, 4 per cent.

ANALYSIS OF CEMENT.

Theoretically the ratio of the lime and alumina (together) to the silica should be as 265 to 100.

Combining weight of lime CaO	= 238.5
" " alumina Al_2O_3	= 26.5
	265.0
" " silica SiO_2	= 100.0

Following are two analysis of good Portland cements, Josson and Burham:—

	JOSSON.	BURHAM.
Lime CaO..................	63.60 %	61.04 %
Silica SiO_2..................	22.60	22.45
Alumina Al_2O_3..............	6.72	6.91
Oxide of iron Fe_2O_3.........	1.69	3.62
Magnesia MgO.............	0.97	1.18
Potash K_2O } Soda Na_2O }..............	1.62	1.86
Sulphate of lime $CaSO_4$.....	——	——
Water H_2O................	——	——
Sulphuric acid..............	1.30	1.44
Carbonic acid................	1.50	1.50
	100.00	100.00

NATURAL CEMENTS.

By Natural cements are meant those which are obtained from natural stone containing lime and clay burned at a comparatively low temperature. This cement rock is usually found in several layers, containing various proportions of clay, lime, etc., and it is only by a judicious mixture of stone from the different layers that a good cement is formed. The rock is quarried, broken into pieces and burned in a kiln. The burnt cement is then crushed into small fragments and ground between ordinary millstones.

The description of impurities in Portland cement is applicable to Natural cements, except the part relating to magnesia. Free magnesia is as objectionable in Natural cement as in Portland, but the greater part of natural cement rocks are argillo-magnesian limestones. In burning, a triple silicate of lime, alumina and magnesia is formed which makes a good cement, but any free magnesia will absorb water and expand as in Portland. Natural cement is generally light colored and quick setting, and is especially adapted to sewer work and places where the mortar is exposed to running water before setting. The requirements for good Natural cement are the same as Portland, except as regards color, weight, tensile strength and the presence of magnesia. The tensile strength should be about as follows:

COMPOSITION NEAT OR SAND	TENSILE STRENGTH LBS. PER SQ. INCH. 24 hours.	1 week.	1 month.	1 year.
Neat cement................	40 to 80	60 to 100	100 to 150	300 to 400
1 part cement to 1 part sand	———	30 to 50	50 to 80	200 to 300

IMPROVED CEMENTS.

This name is given to Natural cements mixed with Portland. The Natural cements are usually light colored and the Portland dark, so that color of the mixture is of some value in determining the quality. It is advisable to obtain samples of the natural or "unimproved" cement, and also of the Portland used in the mixture. By comparing samples of the improved cement with these, a fair idea of its quality may be obtained.

The following tests of "Improved Anchor" cement made at the Chief Engineer's Office, Lehigh Valley Railway, will give a fair idea of the tensile strength of a good "Improved" cement:

COMPOSITION NEAT OR SAND	TENSILE STRENGTH LBS. PER SQ. INCH 24 hours	1 week	1 month	1 year
Neat cement..............	100	140	220	420
1 cement to 2 sand.........	——	30	75	275

Improved cements eventually attain great strength and hardness, and are but little inferior to the lower grades of Portland.

TESTING CEMENT.

On June 21st, 1885, a Committee of the American Society of Civil Engineers recommended a system of testing cement of which the following is a brief synopsis:

It is recommended that tests for hydraulic cement be confined to methods for determining fineness, liability to checking or cracking and tensile strength; and for the latter, for tests of 7 days and upward, that a mixture of 1 part of cement to 1 part of sand for Natural cements, and 3 parts of sand for Portland cements, be used, in addition to trials of neat cement. The quantities used in the mixture should be determined by weight. Usually, when cement has a good reputation and is used in large masses, the testing of every fifth barrel seems to be sufficient; but in very important work where the strength of each barrel may in a great measure determine the strength of that portion of the work where it is used, or in the thin walls of sewers, etc., every barrel should be tested. In selecting the cement for experimental purposes, take the sample from the interior of the original packages at sufficient depth to ensure a fair exponent of the quality, and store the same in tightly closed receptacles, impervious to light or dampness, until required for manipulation, when each sample of cement should

be so thoroughly mixed, by sifting or otherwise, that it shall be uniform in character throughout its mass.

The test for checking or cracking is an important one, and though simple, should never be omitted. It is as follows: Make two cakes of neat cement 2 or 3 inches in diameter, about ½ inch thick, with thin edges. Note the time that these cakes, when mixed with mortar to the consistency of a stiff plastic mortar, take to set hard enough to bear a one-twelfth inch diameter wire loaded with ¼ pound, and a one-twenty-fourth inch wire loaded with 1 pound. One of these cakes, when hard enough, should be put in water and examined from day to day to see if it becomes contorted or if cracks show themselves at the edges, such contortions or cracks indicating that the cement is unfit for use at that time. In some cases the tendency to crack, if caused by the presence of too much unslaked lime, will disappear with age. The remaining cake should be kept in air and its color observed, which for a good cement should be uniform throughout (yellowish blotches indicating a poor quality), the Portland cements being of a bluish gray and the Natural cements being light or dark according to the character of the rock of which they are made. The color of the cements when left in the air indicates the quality much better than when they are put in water.

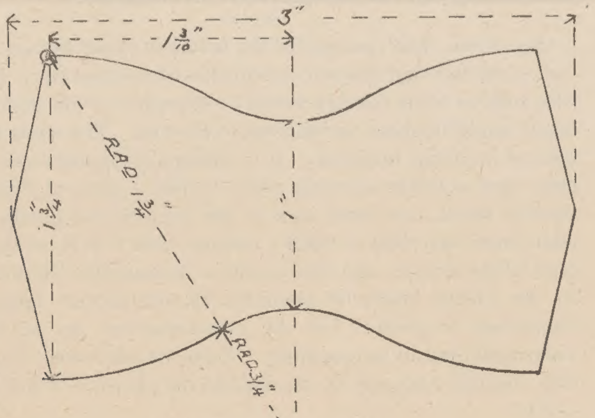
The strength of a cement depends greatly upon the fineness to which it is ground, especially when mixed with a large dose of sand. Cement of the better grades is now usually ground so fine that only from 5 to 10 per cent. is rejected by a sieve of 2500 meshes per square inch, and it has been made so fine that only from 3 to 10 per cent. is rejected by a sieve of 3,200 meshes per square inch. The finer the cement, if otherwise good, the larger the dose of sand it will take and the greater its value. Following is a table showing the results of tests made at the Cairo Bridge:

BRAND OF CEMENT.	Proportion of sand	Tensile strength, lbs. per square inch for different degrees of fineness No. 100 sieve.				
		100%	90%	80%	70%	60%
Louisville 6 months old.	Cement 1 Sand 0	320	335	318	305	319
	Cement 1 Sand 1	283	298	290	280	249
	Cement 1 Sand 2	199	192	181	173	161
Portland 6 months old.	Cement 1 Sand 0	620	621	659	692	712
	Cement 1 Sand 1	478	459	436	391	352
	Cement 1 Sand 2	322	299	263	249	224

The tests should be applied to the cements as offered for sale. If satisfactory results are obtained with a full dose of sand, the trials need go no further. If not, the coarser particles should first be excluded by using a No. 100 sieve, in order to determine approximately the grade the cement would take if ground fine, for fineness is always attainable, while inherent merit may not be. The question of a standard sand seems one of great importance, for it has been found that sands looking alike and sifted through the same sieves, give results varying within wide limits. The material that seems likely to give the best results is the crushed quartz used in the manufacture of sand paper, being both clean and sharp. The degree of fineness should be such that it will all pass a No. 20 sieve, and be caught on a No. 30 sieve. The proportions of cement, sand and water, should be carefully determined by weight, the sand and cement mixed dry and all the water added at once. The mixing must be rapid and thorough, and the mortar, which should be stiff and plastic, should be firmly pressed into the moulds with the trowel, without ramming, and struck off level; the moulds in each instance, while being charged and manipulated, to be laid directly on glass, slate, or some other non-absorbent material. The moulding must be completed before incipient setting begins. As soon as the briquettes are hard enough to bear it, they should be taken from the moulds and be kept covered with a damp cloth until they are immersed. For the sake of uniformity, the briquettes, both of neat cement and those containing sand, should be immersed in water at the end of 24 hours, except in the case of one day tests. Ordinary fresh, clean water, having a temperature between 60 and 70 degrees F., should be used for the water of mixing and immersion of samples. The proportion of water required varies with the fineness, age or other conditions of the cement, and the temperature of the air, but is approximately as follows:

For briquettes of neat cement, Portland, about 25 %
" " " " Natural, " 30 %
For briquettes of 1 part cement and 1 part sand, about 15 % of the total weight of sand and cement.
For briquettes of 1 part cement and 3 parts sand, about 12 % of the total weight of sand and cement.

The object is to produce the plasticity of rather stiff plasterer's mortar. An average of 5 briquettes may be made for each test, only those breaking at the smallest section to be taken. The briquettes should always be put in the testing machine and broken immediately after being taken out of the water, and the temperature of the briquettes and of the testing room should be constant between 60 and 70 degrees F. The following figure shows the form of briquette recommended by the Committee of the American Society of Civil Engineers:



SCALE, FULL SIZE.

GERMAN METHOD OF TESTING PORTLAND CEMENT.

In November, 1878, the Prussian Minister of Public Works issued a series of standard rules for testing Portland cement, which were adopted by nearly all the architectural and engineering associations in Germany, and subsequently served as a basis for standard rules in several adjoining countries. At the instance of the Association of German Cement Manufacturers, these rules have now been altered and several important modifications introduced. The amended rules were published by the Prussian Minister of Public Works in July, 1887, and differ from the rules previously in force as follows: The time of setting of a slow-setting cement is now fixed at two hours instead of half an hour. In testing for expansion, the cake of cement is allowed to set for 24 hours before immersing in water, during which period it is to be kept moist and in the shade. The cement must be ground so finely that not more than 10% residue remains upon a sieve of 900 meshes per square millimetre (5,806 meshes per square inch) and made of wire the thickness of which is one-half the width of the mesh; 100 grams (0.22 lbs.) of the cement is to be used for each test. The strength is ascertained by tensile and compressive tests; the cement in both cases being mixed with three times its weight of sand of a definite size of grain. The breaking area of the tensile briquette is 5 square centimetres (0.775 square inches), and the compression tests are made with cubes of 50 square centimetres (7.75 square inches). The minimum tensile strength of a mixture of 1 part by weight of slow-setting cement mixed with 3 parts by weight of standard sand, after hardening 1 day in air and 27 days under water, is 16 kilogrammes per square centimetre (227.5 pounds per square inch). The crushing strength is 160 kilogrammes per square centimetre (2275.6 pounds per square inch). The standard sand is obtained by sifting clean quartz sand first through a sieve of 50 meshes per square centimetre (387 meshes per square inch), made of wire 0.38 millimetre (0.0146 inch) diameter, then through a sieve of 120 meshes per square centimetre (774 meshes per square inch), made of wire 0.32 millimetre (0.0123 inch) diameter. The sand which remains upon the finer sieve is that which is to be used for the tests. For each series of tests ten briquettes at least must be broken, the average of the ten numbers obtained being taken as the strength of the cement. In making each five briquettes for the tensile test, 250 grammes (0.55 pound) of cement is mixed with 750 grammes (1.65 pound) of standard sand and 100 grammes (0.22 pound) of fresh water, the whole mass being well mixed for five minutes. The mortar is beaten into the moulds for one minute with a spatula weighing about 250 grammes (0.55 pound) until water begins to rise. When the surface has been smoothed with a knife, the mould is carefully removed and the briquette placed in a covered zinc-lined box for 24 hours. It is then immersed in water for the remainder of the hardening period. In making these briquettes by machinery, Dr. Bohme's apparatus is used; 180 grammes of the mortar is placed in the mould and subjected to 150 blows of a hammer weighing 2 kilogrammes (44 pounds). For crushing tests, Dr. Bohme's machine alone is prescribed, the proportion of water and number of blows of the hammer being the same as for tensile briquettes. All the briquettes must be tested immediately they are removed from the water. In breaking the tensile briquettes, the weight must be added at the rate of 100 grams (0.22 pound) per second. It may be mentioned that the amount of water prescribed by the German rules makes the mortar about the consistency of moist earth.

And now, gentlemen, having discussed at considerable length a very dry and dusty subject, let us enquire how it is that every manufacturer produces the best cement on the market. The reason is somewhat as follows: One of the smaller towns in Canada or the States, let us suppose, has risen to the dignity of a city, with a board of works and a duly appointed engineer, who, we hope, is a graduate of the Ontario School of Practical Science, and who is alive to the importance of carefully examining all cement used on public works. Some engineering structure of unusual importance is about to be built, and tenders for materials are asked, among other things cement. Then up comes the great unwashed army of cement manufacturers, who, unlike their German brethren, have not awakened to the advantages to be derived from a trade union, and each deposits his tender accompanied by circulars showing that large quantities of his particular brand have been used on important works all over the country. In due time the tenders are opened, and, as usual, the figures are all closely bunched. The cement men get uneasy and anxious; but not so with our engineer. We notice an unusual gleam in his eye, and with a sardonic smile he vouchsafes the blood-curdling information that the board has ordered a testing machine. After the tests are made the contract is awarded to Mr. A., as his cement stood the highest in the tests. Then another town advertises, and the same performance is reported, and Mr. B. gets the contract, and so on from A to Z. Thus all the manufacturers are satisfied, for each has found a place where his cement stood the highest test, proving conclusively that it is the best in the market.

DISCUSSION.

During the discussion which followed, Mr. Barrett pointed out that in hot summer weather considerable quantities of sand and cement were sometimes mixed dry and stored away ready for wetting up into mortar, but this should never be tolerated, as the sand, although apparently perfectly dry, contains sufficient moisture to cause incipient setting in the cement, thereby detracting from its strength.

Mr. Wells: Why are not 24-hour tests made of mixtures of sand and cement, the same as with neat cement?

Mr. Ball: Although 24-hour tests of neat cement are useful either in themselves or in comparison with the 7-day tests, 24-hour tests of a mixture of sand and cement are of no value. 24-hour tests of neat cement, in themselves, give little or no indication of the ultimate strength which that cement will attain, but such tests are useful where a quick setting cement is required, as for sewers, in running water, &c., where quick setting is desirable, or where a considerable strain will be brought to bear soon after the cement is in place; they are also useful when compared with 7-day tests, as before mentioned. Sand does not diminish the ultimate strength of cement so much as it retards its setting and hardening, as will be seen by a comparison of the strengths of neat cement and of mortar at the ages of 7-days and one year. Mortar made with cement and sand at the age of 24-hours would possess very little strength, and would give no indication of the ultimate strength.

Mr. Johnson: I would like to ask the speaker's opinion on the practice of specifying the best quality of cement for first class masonry, and allowing inferior grades in third or second class masonry.

Mr. Ball: This is a very common mistake. Stones accurately

cut and fitted will stand without cement, as may be seen in ruins of ancient buildings, and first class masonry, with carefully laid courses, well bonded and joints dressed to half an inch for ten inches back approximates to this. But in second or third class masonry, the courses are not so carefully arranged nor the joints so accurately dressed, and more irregular pieces, such as spalls, &c., are allowed in the heart of the wall, in consequence of which the bond is not so strong as in first class, and there is more dependence on the binding power of the cement. Take concrete—where the stones in themselves have absolutely no bond at all—the very best cement is required ; so, in my opinion, if any difference in the quality of cement is permissible in different classes of masonry, the best cement should be placed in that class in which the bond of the stones is least able to afford sufficient strength.

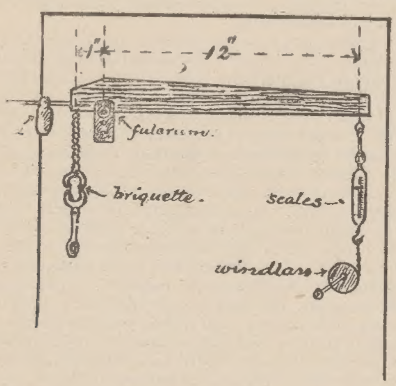
Mr. Barrett : Why are tests made of the tensile strength of cement instead of the compressive strength, which is the principal requirement in work ?

Mr. Ball : It has been found by experiment that the tensile strength of cement bears a nearly constant ratio to its compressive strength—about 1-10. A very large and strong machine would be required to make compressive tests, beside which it is difficult to say at what particular weight a cube is crushed, as it splits up into smaller pieces and breaks gradually, whereas tensile briquettes break instantly.

Mr. Woolnough also pointed out that in specifying the weight per struck bushel of Portland cement it was necessary to test a whole bushel filled from a hopper placed at a certain specified height above the measure. A half or quarter bushel filled in the same manner would not be a half or a quarter of the weight of the whole bushel.

Mr. Ball stated that he did not place much value on this test, as it required a large quantity of the cement, was troublesome to make, and was only useful in indicating whether the cement was well burned or not, which could be ascertained by methods before described.

Mr. Virgil G. Marani gave an illustration of a very practical and easily constructed cement testing machine. A lever of wood is constructed, at one end of which, 1″ from fulcrum, the appliance for holding the briquette is attached. At a distance,



say 12″ on other side of fulcrum, an ordinary spring scales is hooked, the strain being produced by a small windlass. Therefore when scales, 12″ from fulcrum, register 10 lbs. a time of fracture of briquette, the cement has stood a test of $12 \times 10 = 120$ lbs. Before making test, the weight of scales is counterbalanced by a sliding weight at *a*. This, although not an absolutely accurate method, gives very satisfactory results.

PERSONAL.

Mr. J. A. Pearson, President of the Toronto Architectural Sketch Club, is visiting parents and friends in England.

Mr. M. B. Aylesworth, architect, Toronto, is making a tour of Europe, in search of architectural knowledge.

Mr. Geo. W. Gouinlock, architect, Toronto, has recently entered into partnership with Mr. Garland, the firm name being Gouinlock & Garland.

Mr. Willis Chipman, C. E., proposes to visit Europe shortly. One object he has in view is to witness the effect of cold weather upon the operation of sewage farms in Germany.

The Hon. J. A. Ouimet has been appointed Minister of Public Works for the Dominion, and the Hon. John Haggart has been placed at the head of the Department of Railways and Canals.

The partnership recently entered into between Messrs. Smith & Gemmell and Mr. E. B. Jarvis, architects, of Toronto, has been dissolved. Mr. Jarvis has again opened offices in the Traders' Bank building.

Mr. John Galt, C. E., Toronto, has patented a steam or water heating furnace consisting of sections, with means for uniting them and providing circulation of water or steam from section to section, said sections being provided with a fire-chamber in the upper part thereof, with a stratum of water above and around the same, and flues situated beneath said chambers for conducting heated products of combustion therefrom through said section to the outlet.

OUR ILLUSTRATIONS.

NEW HIGH SCHOOL, MONTREAL.—ALEX. C. HUTCHISON, ARCHITECT.

This building occupies a block of land lying between Peel and Metcalfe streets, formerly the site of the High School building destroyed by fire over a year ago. It has a frontage on each street of about 250 feet by a depth of about 216 feet, and a height of two stories above the basement.

The basement contains the Smead-Dowd heating apparatus, coal rooms, play rooms, janitor's apartments, chemical and physical laboratories, with lecture and work rooms attached, and manual training room. The main and second storey floors contain thirty-two large and eight small class rooms, offices for superintendent, treasurer, principals, board room, &c.

The central portion of the building fronting on Metcalfe street contains a drill hall, 90′ 0″ × 56′ 0″, while the second storey of the central portion of the building, fronting on Peel street, contains an assembly hall capable of seating about 1300 persons. The building is wired throughout for electric lighting, and all the class rooms, lecture rooms, &c., are in telephone connection with the principal's room.

The elevations of the building are faced with pressed brick with trimmings of olive green New Brunswick sand stone.

HOUSES ON BAY ST. SOUTH, HAMILTON, ONT.—JAS. BALFOUR, ARCHITECT, HAMILTON.

The corner house is a reconstruction, having formerly been a cottage.

RESIDENCE OF CAPT. S. CRANGLE, ROSEDALE ROAD, TORONTO. —GORDON & HELLIWELL, ARCHITECTS, TORONTO.

"CANADIAN ARCHITECT AND BUILDER" COMPETITION FOR A SUBURBAN COTTAGE—DESIGN BY "JACK PLANE" (J. W. SIDDALL), TORONTO, AWARDED THIRD POSITION.

"METHODS IN COLORING."

Mr. Scott Morton recently read a paper before the Architectural Association on "Methods in Coloring" and commenced with the statement that "the true color-feeling is a rare thing." This talented lecturer gave in his paper a few color laws as follows : Different tones of the same color tell well beside each other or in the same composition. Take, for example, all the tints on a piece of self-colored velvet or silk. There are unending gradations of these. Much interesting work has been done on this idea on the lowest scale of color, viz., that of greys. Mr. Waterhouse expresses his predilections for pearly greys and drabs, including ivory, red or green, with very small points of delicate turquoise blue. Omitting the red or green meantime, his predilections for the pearly greys and drabs, including ivory, are well worthy of being kept constantly in mind, as these are in sympathy with the general greyness of our climate or surroundings, but it will strike all colorists that unless these tints are handled in a masterly way, there is the danger of insipidity. Mr. Scott Morton says that light is an important element in color work. If there is a direct sky light falling into the room, the reflection from the floor, which may be carpeted, counts for much, as its influence is felt on the ceiling and parts of walls not reached by direct light. He suggests for working out a color scheme, the mixing of a pot of what might be termed the dominant or key-color, and from that pot take more or less color for harmonizing and contrasting every tint employed.

One of the chief reasons for the failure of cheap houses to look well is the fact that they are overloaded with ornament. If those who wish to build cheaply would be content to build plainly, the result would be more satisfactory to the eye. The same fault is noticed in cheap furniture. It is always disfigured with fancy turns and machine carving, while to find a piece of plain, substantial finish, one must look at the high priced goods. Too many men only able to build a cottage, load it with weak imitations of the palace, and the result is thoroughly inharmonious. In the cheap house let plainness of construction reign from foundation to gable. Let the ornamentation be, not in the wood-work, but in the painting. Then the effect may be whatever desired, and may be changed at the pleasure of the owner. —*Ex.*

American manufacturers of radiators are reported to have arrived at an understanding by which competition will be restricted.